

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—XII

TYÔZABURÔ TANAKA

GYMNOSPORANGIUM ASIATICUM Miyabe in Shokubutsugaku Zasshi (Bot. Mag.) Tôkyô, 17¹⁹²: 34. M. 36, ii, Feb., 1903 (nomen nudum); in Ideta's Nippon Shokubutsu Byôrigaku (Handb. Pl. Diseases in Japan) ed. 3, Tôkyô, Shôkwabô, M. 36, iv, Apr., 1903, 6. 214-217, fig. 50, 51 (nomen subnudum); Yamada in Ômori, J. & Yamada, G. Shokubutsu Byôrigaku (Plant Pathology) Tôkyô, Hakubunkwan, M. 37, ix, Sept., 1904, p. 303-306. (Japanese.)

Description by G. Yamada:

O. Pycnia epiphyllous on spots, first small, punctiform and orange-yellow, gregarious, few in number; pycnospores small, fusoid.

I. Aecia hypophyllous, on thickened, well-developed, brown spots having a beautiful, flavo-rubescens margin, very slender, 3-6 mm. high, cinereous; peridium tubular, not recurved in dehiscence, irregularly torn at the end, liberating reddish-brown aeciospores; aeciospores globose or sub-angular, minutely-verrucose, the pores several.

On *Pyrus sinensis* (Japanese sand-pear) and *Cydonia vulgaris*.

III. Telia foliicolous, forming reddish-brown, gelatinous masses, deep-fuscous when desiccated, pulvinate with sticky, orange-yellow teliospores; teliospores long-pediceled, orange-yellow, those produced on the outer part of the telium broad and short, thick-walled and deep colored, those formed in the inner part of the telium slender, thin-walled and light colored, readily germinating from the places near the septum; promycelia 1-2, rarely produced from the apex of the teliospore; sporidia 2-3 on a promycelium.

On *Juniperus chinensis* and *J. chinensis* var. *procumbens*.

The sporidia of III readily produce *Roestelia* (*R. koreaensis* P. Henn.) on Japanese pear leaves, according to the inoculation test conducted by Miyabe.

Ideta (under supervision of Miyabe) gives the spore characters as follows: "Teliospores 2-celled, fusoid, 45-70 x 20-25 μ , long-pediceled." (*In Nippon Shokubutsu Byôrigaku* ed. 4, pt. 2: 470. M. 44, 1911. Japanese.)

Notes: Sydow first described *Gymnosporangium japonicum* from the specimens on the branch of *Juniperus chinensis* collected by Shirai at Komaba, Tôkyô (*in Hedwigia*, Beibl. 38³: (141) May-June, 1899), and later, Shirai succeeded in producing *Roestelia* (*R. koreaensis*) on Japanese pear leaves by inoculating with some mixed forms of *Gymnosporangium* found on the leaves and stems of *Juniperus chinensis*, and which he called *G. japonicum* (*in Zeitsch. f. Pflkr.* 10¹: 1-4, pls. 1-2. Apr., 1900). These results apparently induced many Japanese pathologists to believe that *G. japonicum* is the causal organism of the devastating Japanese pear-rust, though Miyabe clearly defines that *G. asiaticum* occurs only on the leaves. The first comprehensive description of *G. asiaticum* given by Yamada also limits the occurrence of the telia to the juniper leaf only, and Yoshino later showed that the pear-rust is caused only by the leaf-inhabiting form of *Gymnosporangium* (*G. asiaticum*) in the Kyûshû island, and not by the stem-inhabiting form which he never found existing in the island (*in Shokubutsugaku Zasshi*, Bot. Mag., Tôkyô, 19²²²: 167-168. M. 38, vii, July, 1905. Japanese). Ideta also describes the telial stage from the leaf-inhabiting form only, though he was liberal in bringing the name *G. asiaticum* into the synonymy with *G. japonicum* in his latest description (l. c. ed. 4, pt. 2: 467, 469-470. 1911).

Despite the existence of the valid name *Gymnosporangium asiaticum* applied to the form on the juniper leaves, Sydow renamed the leaf-inhabiting form as *Gymnosporangium haraeum*, based upon the material collected by K. Hara from Mino province (*in Ann. Mycol.* 10⁴: 405. Aug., 1912). Using the fresh material taken from the juniper plant upon which Sydow's type was collected, Hara succeeded in producing pear-rust by inoculation (*in Shokubutsugaku Zasshi* 27³¹⁹: 348. T. 2, vii, July, 1913. Japanese). At the same time, Itô succeeded in producing rust on *Photinia villosa* by inoculating the stem-inhabiting form which he determined to be *G. japonicum* Syd. (*in Shok. Zass.* 27³²³: 221-

222. Nov., 1913). Itô concludes, therefore, that the leaf-inhabiting *Gymnosporangium* (*G. haraezanum* = *G. asiaticum*) is the cause of the Japanese pear-rust (*Roestelia koreaensis*), while the stem-inhabiting form (*G. japonicum*) is connected with the *Photinia* rust (*Roestelia photiniae* P. Henn.). (See l. c. p. 221, and also in Byôchû-gai Zasshi, Journ. Pl. Prot. 4³: 178-182. T. 6, iii, Mar., 1917. Japanese.) Jackson also succeeded in infecting sand-pear and quince with the teliospores from *Gymnosporangium koreaensis* Jacks. (= *G. asiaticum* = *G. haraezanum*) and recommended *G. photiniae* Kern (in Bull. N. Y. Bot. Gard. 7: 443. Oct., 1911) to supersede *G. japonicum*, following Itô's successful inoculation. (See Journ. Agr. Res. 5: 1006, 1007. Feb., 1916.) Dietel, on the other hand, made examination of aecia found on the leaves of *Cydonia vulgaris*, *Pirus sinensis* and *Pourthiaea villosa* (*Photinia villosa*) collected by Kusano at the Botanic Garden, Tôkyô, and brought altogether under one species *G. confusum* Plowr. (in Engler's Bot. Jahrb. 28³: 286, May, 1900), but Itô states that *G. confusum* never occurs in Japan, though Shirai lists it in his Nippon Kinrui Mokuroku (A list of Japanese fungi hitherto known, Tôkyô, Nippon Engei Kenkyûkwai, M. 38, 1905, p. 39) and he also maintains that the first two must be identical with *G. asiaticum* and the third must be *G. japonicum* (in Byôchû-gai Zasshi 4³: 180. Mar., 1917).

In Korea, pear-rust was known quite early and its connection with juniper was suspected by the Korean agriculturist Soh You-Koh in his work *Haing po chi* written as early as about 1845. (Shirai, in Ann. Phytopath. Soc., Japan 1¹: 2. Jan., 1918.) In Japan, Hori first noticed the connection of the pear-rust with juniper *Gymnosporangium* in 1892, and he studied the actual damage of the pear plantation in Okayama first in 1900. (See Hori's Shokubutsu Byôgai Kôwa [Lectures on plant diseases] v. 2. Tôkyô, Seibidô, t. 5, xi, Nov., 1916, p. 301-302 [Japanese].) The infection of quince (*Cydonia vulgaris*) by the pear-rust fungus was reported by Miyabe and all later investigators, but Sydow made it a new species giving the name *Gymnosporangium spiniferum* to the aecial stage. (See Ann. Mycol. 10: 78. Feb., 1912.) Itô conceives this to be identical with *G. asiaticum* (l. c. p. 181), but

Kern brings this into the synonymy with *G. photiniae* (in Mem. N. Y. Bot. Gard. 6: 246. Aug., 1916). Successful inoculation of *Cydonia japonica* by the pear *Gymnosporangium* was also reported by Yoshino (l. c. p. 168), Hori (l. c. p. 309) and Itô (l. c. p. 182). According to Yoshino (in Shok. Zass. 20²³²: 91. M. 39, v, May, 1906. Japanese), Ideta (l. c. ed. 4, p. 467) and Itô (l. c. 4⁵: 327), natural infection of European pear (*Pyrus communis*) is found but of slight extent, and Hori adds *Pyrus Toringo* and *Cydonia sinensis* as incidental hosts (in Hori's Nôsakumotsu Byôgaku, [Discourse on plant diseases], 7 impr. 1911. p. 292. Japanese). Ideta first reported that *G. asiaticum* occurs also on the leaves and stems of *Juniperus rigida* (in Shok. Zass. 18²¹¹: 157-158. M. 37, viii, Aug., 1904. Japanese), but later he corrected the statement in accordance with Miyabe's inoculation tests, that the leaf-inhabiting form only can produce aecia on pear leaves (l. c. 18²¹³: 223. Oct., 1904. Japanese). Later investigators all agreed with Ideta's final statement (see Hara, in Engei no Tomo [Friend of Hort.] 13⁹: 811-812. T. 6, ix, Sept., 1917. Japanese), except Itô who doubts these statements because only exceptional species can infect both the Sabina and Oxycedrus groups of juniper (in Byôchû-gai Zasshi 4³: 182-183). R. Nodzu even suggested that the pear-rust infects several species of *Chamaecyparis* (in Shimane Kenritsu Nôji Shikenjô T. 4 Nendo Gyômu Kôtei, [Ann. Rept. Simane Agr. Exp. Stat. for 1915]. p. 93. Japanese), but his suggestion received little credit by succeeding authors. Yoshino, on the other hand, succeeded in obtaining rust on *Cydonia vulgaris*, *C. japonica* and the Japanese pear by infecting with a *Gymnosporangium* found on the small stems of *Juniperus chinensis* in the Saga prefecture (in Shok. Zass. 20²³²: 91. May, 1906). He describes this stem-inhabiting telium as being "only swollen or expanded or globular, appearing quite different from the ordinary stem-inhabiting form which expands greatly with moisture into a tongue-like petal." This shows, according to Yoshino, that the telium of *G. asiaticum* occurs also on the small twigs of juniper in a form quite distinct from that of *G. japonicum*.

GYMNOSPORANGIUM YAMADAE Miyabe in Shokubutsugaku Zasshi (Bot. Mag.) Tôkyô, 17¹⁰²: 34-35. M. 36, ii, Feb., 1903 (nomen

nudum); Yamada in Ômori, J. & Yamada, G. *Shokubutsu Byôrigaku* (Plant Pathology) Tôkyô, Hakubunkwan, M. 37, 1904, p. 306-308, fig. 38 (Japanese).

Gymnosporangium Yamadaï Miyabe ex Ideta in *Nippon Shokubutsu Byôrigaku* (Handb. Pl. Diseases in Japan) ed. 3, Tôkyô, Shôkwabô, M. 36, iv, Apr., 1903 (nomen subnudum); Miyabe in Ideta ditto ed. 4, pt. 2: 471-474, fig. 174. M. 44, 1911 (Japanese).

Description by G. Yamada and K. Miyabe combined:

I. Aecia hypophyllous, on more or less thickened, reddish-brown spots, cylindrical, thick, 0.4-0.5 mm. in diam., 5-8 mm. high; peridium fulvous, splitting into a fine lace-like network; peridial cells narrow and elongated, 60-80 x 20-24 μ , inner wall smooth, outer wall slightly verrucose, side wall tuberculate with short papillae and never making elongated ridges; aeciospores subglobose or polygonal, 16-24 μ in diam., wall thick, brown, finely verrucose, the pores 8. scattered.

On *Pyrus Malus* (Apple), *Pyrus spectabilis*, and *P. Toringo*.

III. Telia caulicolous, from a perennial mycelium, appearing on reddish-brown, spheric swellings of the host stem, of somewhat shining appearance, disclosed by the rupturing of the cork in irregular fissures, flavo-rubescens, flat, petal- or tongue-shaped, irregular, deep-fuscous when desiccated; teliospores 2-celled, oblong, broad-ellipsoid, obovoid or clavate, upper cell always larger, frequently with thick-walled, obtuse papilla at the apex. 40-50 x 15-22 μ .

On *Juniperus chinensis* and *J. chinensis* var. *procumbens*.

Apple culture of the northeastern territories has been menaced by the disease. In Sapporo, Hokkaidô, it made its first appearance in 1902 with the introduction of *J. chinensis*, carrying the fungus from the south. According to Ideta (l. c. ed. 4 p. 472), Miyabe first found in 1904 the connection of apple rust with this particular *Gymnosporangium* inhabiting on the juniper stems. The aecial stage develops in July and August causing discoloration of apple leaves, which frequently results in defoliation. The telial stage appears on the juniper in April or May in the main island, and in May or June at Sapporo, Hokkaidô.

Illustrations: 4 text-figures by Yamada (l. c. p. 307) are given, showing telia on juniper branch, cross section on the swollen stem, teliospores and germination of teliospores.

Notes: The finding of aecia on *Pyrus spectabilis* by Shirai in Tôkyô was reported by Dietel as ? *Gymnosporangium clavariaeforme* Jacq. (in *Hedwigia* 37: 216. July, 1898) and by P. Sydow as *Gymnosporangium* ? *clavariiforme* (Jacq.) Rees (do. *Beibl.* 37^r: (207) Nov.-Dec., 1898). P. Hennings listed an aecium on *Pyrus Toringo* collected by Shirai at Nikkô as ? *G. clavariiforme* (Jacq.) Rees (in *Engler's Bot. Jahrb.* 28: 262. Mar., 1900), and he later reported *G. clavariiforme* from Tôkyô, found by Hori on *P. spectabilis* (do. 31⁴⁻⁵: 732. Aug., 1902). These are all likely to represent *G. Yamadae*. Under *G. Yamadae* Miyabe sp. nov., Kern presented a description of the aecial stage found on *Pyrus spectabilis* by Nambu at Tôkyô (in *Bull. N. Y. Bot. Gard.* 7²⁶: 466. Oct., 1911), and Sydow later described the telial stage under the same name from material presented by M. Miura (in *Ann. Mycol.* 12: 159-160. Apr., 1914). Itô (in *Byôchû-gai Zasshi, Journ. Pl. Prot.* 4⁴: 244-245. Apr., 1917) ventured, however, to bring this name into the synonymy with *G. chinensis* Long (in *Journ. Agr. Res.* 1: 345. Jan., 1914) but all later investigators have considered the latter to be identical to *G. asiaticum* (= *G. haraeantum* = *G. koreaensis*). See Clinton, in *Ann. Rept. Conn. Agr. Exp. Stat.* for 1914 p. 15, 16. 1914; Jackson, in *Journ. Agr. Res.* 5: 1006. Feb., 1916 and Kern in *Mem. N. Y. Bot. Gard.* 6: 247-249. Aug., 1916.

GYMNOSPORANGIUM IDETAE Yamada ex K. Hara in Hara's Kwaju Byôgairon (Discourse on fruit diseases) Irie-chô, Shidzuoka-ken, T. 5, xi, Nov., 1916. p. 95 (Japanese): in *Shidzuoka-ken Nôkwaihô* (*Journ. Agr. Soc., Shidzuoka prefecture*) no. 287: 51-52. T. 10, ix, Sept., 1921 (Japanese).

Description from Hara's second article:

O. Pycnia epiphyllous, immersed, on orbicular or irregularly-orbicular orange-yellow spots of 5-15 mm. broad, which later turn into beautiful reddish-brown color, globose, with pointed apex; pycnospores fusoid, exude with mucilaginous substance, 8-10 x 3-3.5 μ .